

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/38005

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G01B 9/02
 US CL : 356/450, 491-495, 487, 489

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 356/450, 491-495, 487, 489

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,950,103 A (SCHMIDT-WEINMAR) 13 April 1976 (13.04.1976), Figure 17.	1-34

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search

23 March 2004 (23.03.2004)

Date of mailing of the international search report

14 APR 2004

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US
 Commissioner for Patents
 P.O. Box 1450
 Alexandria, Virginia 22313-1450
 Facsimile No. (703) 305-3230

Authorized officer

Hwa S Lee

Telephone No. (517) 272-2419

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/38004

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G01B 9/02
US CL : 356/450, 491-495

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 356/450, 491-495

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,128,080 A (JANIK et al) 03 October 2000 (03.10.2000), see entire document.	1-12
Y		13-17
Y,P	US 2003/0095264 A1 (RUCHET) 22 May 2003 (22.05.2003), see entire document.	13-17

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

Date of the actual completion of the international search

23 March 2004 (23.03.2004)

Date of mailing of the international search report

12 APR 2004

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
Facsimile No. (703) 305-3230

Authorized officer

Hwa S Lee

Telephone No. (571) 272-2419

[home](#) [contact](#) [product search](#) [join SPIE](#) [view cart](#)



The International Society
for Optical Engineering

Furthering Innovation in Optics and Photonics

SPIE HOME	PUBLICATIONS	CONFERENCES	EXHIBITIONS	MEMBERSHIP	EDUCATION	
SPIE BOOKSTORE	DIGITAL LIBRARY	JOURNALS	PROCEEDINGS	SPIE PRESS	MAGAZINES	AUTHOR INFORMATION

SEARCH PUBLICATIONS »

Volumes
 Papers



ADVANCED SEARCH



VIEW CART

BROWSE PUBLICATIONS

- [Nanotechnology](#)
- [Defense & Security](#)
- [Aerospace, Remote Sensing, & Astronomy](#)
- [Automation, Inspection, & Product Engineering](#)
- [Biomedical Optics](#)
- [Communications & Fiber Optics](#)
- [Electronic Imaging, Displays, & Medical Imaging](#)
- [Lasers & Applications](#)
- [Microelectronics, Optoelectronics, & Micromachining](#)
- [Optical Physics, Chemistry, & Biology](#)
- [Optical Science & Engineering](#)
- [Signal & Image Processing](#)

Abstract

PUBLICATIONS

Three channel phase-shifting interferometer using polarization-optics and a diffraction grating

Add to cart:

FULL TEXT PDF

HARD COPY

Andrea Hettwer, Jochen Kranz, Johannes Schwider

Publication: [Optical Engineering](#) 39(04), p. 960-966,
Roger A. Lessard; Ed.

Publication Date: Apr 2000

Abstract

A modified Michelson interferometer is described by which three, by $-\pi/2$, 0 and $+\pi/2$ phase-shifted interferograms can be taken simultaneously by a single CCD camera using a binary diffraction grating and polarization optics. Hence measurements of dynamic events and in adverse conditions are possible. The experimental setup, first results and a mathematical error analysis are presented. (Copyright)2000 Society of Photo-Optical Instrumentation Engineers.

©2006 SPIE--The International Society for Optical Engineering. Downloading of the abstract is permitted for personal use only.

[« Return to Search Results](#)

| [SPIE Home](#) | [Publications](#) | [Conferences](#) | [Exhibitions](#) | [Membership](#) | [Education](#) |

Telephone: +1 888-504-8171 or +1 360/676-3290 | Fax +1 360/647-1445 | Email: spe@spe.org

© 1994- 2006 SPIE—The International Society for Optical Engineering

| [Privacy Policy](#) |

SPIE is a not-for-profit international society dedicated to advancing optics and photonics.



[SPIE DL home](#) | [Scitation home](#) | [Search SPIN](#) | [help](#) | [contact](#) | [sign in](#) | [sign out](#)

[SPIE Digital Library](#)

[Proceedings](#)

[Journals](#)

[My SPIE Subscription](#) | [My E-mail Alerts](#) | [My Article Collections](#)

[Home](#) » [Proc. of SPIE](#) » [Volume 2544](#)

SEARCH PROCEEDINGS

[Search](#)

[Advanced Search](#)

BROWSE PROCEEDINGS

- [Proceedings](#)
 - [By Year](#)
 - [By Symposium](#)
 - [By Volume No.](#)
 - [By Volume Title](#)
 - [By Technology](#)

BROWSE JOURNALS

- [Journals](#)
 - [Optical Engineering](#)
 - [J. Electronic Imaging](#)
 - [J. Biomedical Optics](#)
 - [J. Micro/Nanolithography, MEMS, and MOEMS](#)
 - [J. Applied Remote Sensing](#)
 - [J. Nanophotonics](#)

SUBSCRIPTIONS & PRICING

- [Institutions & Corporations](#)
- [Personal subscriptions](#)

GENERAL INFORMATION

- [About the Digital Library](#)
- [Terms of Use](#)
- [SPIE Home](#)

Abstract

Proceedings of SPIE -- Volume 2544

Interferometry VII: Techniques and Analysis, Małgorzata Kujawinska, Ryszard J. Pryputniewicz, Mitsuo Takeda, Editors, June 1995, pp. 74-86

Options for selected Articles

Choose an action

?

Adding to MyArticles will open a second window
(Scitation login required).

YOUR CART

Full Text: [PDF (920 kB)]

Real-time fringe pattern processing and its applications

Suezou Nakadate

Univ. of Rochester and Tokyo Institute of Polytechnics (Japan)

Masaki Isshiki

Tokyo Institute of Polytechnics (Japan)

Two real-time phase mapping methods for fringe patterns are presented, which are based on a spatial phase-shifting with three fringe patterns, and on a spatial synchronous detection for a tilted fringe pattern. A digital TV-image processor is implemented which bases on the two fringe processing techniques. Applications of the present methods to surface shape measurements using a polarization interferometer and a fringe projection technique, and to a surface deformation measurement using a holographic interferometer are described. Worst phase errors are analyzed theoretically which are caused by an additive intensity noise of input fringe signals and a multiplicative intensity noise due to misalignments of a measuring system. A phase error due to a digitization of calculations is also evaluated numerically.

©2005 COPYRIGHT SPIE--The International Society for Optical Engineering. Downloading of the abstract is permitted for personal use only.

doi:10.1117/12.211852

[Scitation Citing Articles](#) | [CrossRef Citing Articles](#) | [All Citing Articles](#)



SPIE is a member of CrossRef.

Smithsonian/NASA ADS Physics Abstract Service

- [**Find Similar Abstracts** \(with default settings below\)](#)

[Toggle Highlighting](#)

- [**Table of Contents**](#)
- [**Citations to the Article \(2\) \(Citation History\)**](#)
- [**Refereed Citations to the Article**](#)
- [**Also-Read Articles \(Reads History\)**](#)
-
- [**Translate Abstract**](#)

Title: Real-time fringe pattern processing and its applications

Authors: Nakadate, Suezou; Isshiki, Masaki

Affiliation: AA(Univ. of Rochester and Tokyo Institute of Polytechnics) AB(Tokyo Institute of Polytechnics)

Publication: Proc. SPIE Vol. 2544, p. 74-86, Interferometry VII: Techniques and Analysis, Malgorzata Kujawinska; Ryszard J. Pryputniewicz; Mitsuo Takeda; Eds. ([SPIE Homepage](#))

Publication Date: 06/1995

Origin: [SPIE](#)

Abstract Copyright: (c) 1995 SPIE--The International Society for Optical Engineering. Downloading of the abstract is permitted for personal use only.

Bibliographic Code: 1995SPIE.2544...74N

Abstract

Two real-time phase mapping methods for fringe patterns are presented, which are based on a spatial phase-shifting with three fringe patterns, and on a spatial synchronous detection for a tilted fringe pattern. A digital TV-image processor is implemented which bases on the two fringe processing techniques. Applications of the present methods to surface shape measurements using a polarization interferometer and a fringe projection technique, and to a surface deformation measurement using a holographic interferometer are described. Worst phase errors are analyzed theoretically which are caused by an additive intensity noise of input fringe signals and a multiplicative intensity noise due to misalignments of a measuring system. A phase error due to a digitization of calculations is also evaluated numerically.

[Bibtex entry for this abstract](#) [Preferred format for this abstract \(see Preferences\)](#)

[Toggle Highlighting](#)[Add this article to private library](#)[Remove this article from private library](#)

Find Similar Abstracts:

Use: Authors

 Title Abstract Text

Return: Query Results Return items starting with number



[SPIE DL home](#) | [Scitation home](#) | [Search SPIN](#) | [help](#) | [contact](#) | [sign in](#) | [sign out](#)

[SPIE Digital Library](#)

[Proceedings](#)

[Journals](#)

[Optical Engineering](#)

Optical Engineering

[Home](#) » [Journals](#) » [Opt. Eng.](#) » [Volume 42](#) » pp. 367

SEARCH OE

[[Previous / Next Abstract](#) | [Issue Table of Contents](#)]



[Advanced Search](#)

BROWSE OE

- [Current Issue](#)
- [Current Volume](#)
- [All Volumes](#)

GENERAL INFORMATION

- [About the Journal](#)
- [Citation Format](#)
- [Subscriptions & Information](#)
- [E-mail Alerts](#)
- [Terms of Use](#)
- [Institutions & Corporations](#)
- [SPIEWeb](#)

Abstract

Optical Engineering -- February 2003 -- Volume 42, Issue 2, pp. 367-372

Options for selected Articles

Choose an action



Adding to MyArticles will open a second window
(Scitation login required).



Full Text: [[HTML](#) [Sectioned HTML](#) [PDF \(635 kB\)](#)]

Large surface profile measurement with instantaneous phase-shifting interferometry

N. R. Sivakumar, W. K. Hui, K. Venkatakrishnan, and B. K. A. Ngoi

Nanyang Technological University, Precision Engineering and Nanotechnology Centre, School of Mechanical and Production Engineering, Nanyang Avenue, Singapore 639798

(Received Mar. 13, 2002; revised Jul. 9, 2002; accepted Jul. 15, 2002)

Surface profile measurement of smooth surfaces is a vital area in many of today's industries, especially in wafer fabrication. The increased need for high-speed, noncontact online measurement with high accuracy and repeatability is of great interest for practical purposes. In this work, a modification of Michelson interferometers in combination with instantaneous phase-shifting interferometry is proposed for high-speed large flat-surface profiling. Experiments are carried out on a patterned wafer surface. The results obtained using this system are compared with a commercial profiler system to demonstrate the validity of the principle. ©2003 Society of Photo-Optical Instrumentation Engineers.

doi:10.1117/1.1532331

PACS: 06.30.Bp, 07.60.Ly, 85.40.Qx

[Show References](#) | [Scitation Citing Articles](#) | [CrossRef Citing Articles](#) | [All Citing Articles](#)

Citation links [e.g., [Phys. Rev. D 40, 2172 \(1989\)](#)] go to online journal abstracts. Other links (see Reference Information) are available with your current login. Navigation of links may be more efficient using a second browser window.

[Additional Information](#)



[SPIE DL home](#) | [Scitation home](#) | [Search SPIN](#) | [help](#) | [contact](#) | [sign in](#) | [sign out](#)

[SPIE Digital Library](#)

[Proceedings](#)

[Journals](#)

[My SPIE Subscription](#) | [My E-mail Alerts](#) | [My Article Collections](#)

[Home](#) » [Proc. of SPIE](#) » Volume 1531

SEARCH PROCEEDINGS

[Search](#)

[Advanced Search](#)

BROWSE PROCEEDINGS

[Proceedings](#)

- [By Year](#)
- [By Symposium](#)
- [By Volume No.](#)
- [By Volume Title](#)
- [By Technology](#)

BROWSE JOURNALS

[Journals](#)

- [Optical Engineering](#)
- [J. Electronic Imaging](#)
- [J. Biomedical Optics](#)
- [J. Micro/Nanolithography, MEMS, and MOEMS](#)
- [J. Applied Remote Sensing](#)
- [J. Nanophotonics](#)

SUBSCRIPTIONS & PRICING

- [Institutions & Corporations](#)
- [Personal subscriptions](#)

GENERAL INFORMATION

- [About the Digital Library](#)
- [Terms of Use](#)
- [SPIE Home](#)

Abstract

Proceedings of SPIE -- Volume 1531

Advanced Optical Manufacturing and Testing II, Victor J. Doherty, Editor, January 1992, pp. 119-127

Options for selected Articles

Choose an action

[Go](#)

Adding to MyArticles will open a second window
(Scitation login required).

[YOUR CART](#)

Full Text: [PDF (450 kB)]

Simultaneous phase-shift interferometer

Chris L. Koliopoulos

Phase Shift Technology, Inc. (USA)

Interferometric testing of large optics over long path lengths has been hampered by vibration in the test set-up. The precision of phase measuring interferometry has not been able to provide measurements in vibration environments due to the time required to perform the required phase shift between multiple images of the interferogram. The simultaneous phase shift interferometer (SPSI) has eliminated effects of vibration from phase measurements by creating four separate phase shifted interferograms simultaneously, viewed with four CCD cameras. The CCD cameras provide electronic shutter exposure control which effectively 'freezes' the interference patterns producing high contrast interferograms even with severe vibration. Polarization optics are used to maintain the appropriate phase relationships between the four interferograms. Four separate synchronized video digitizers are used to digitize the interferograms to a maximum resolution of 380 by 240 pixels by 8 bits per pixel. The phase at each pixel in the interferogram is calculated by a PC/486 based microcomputer which also provides complete analysis and graphics of the measurement. Averaging of multiple measurements to reduce the effects of air turbulence is done automatically.

©2005 COPYRIGHT SPIE--The International Society for Optical Engineering. Downloading of the abstract is permitted for personal use only.

doi:10.1117/12.134852

[Scitation Citing Articles](#) | [CrossRef Citing Articles](#) | [All Citing Articles](#)